

Sustainable AI: Environmental Implications, Challenges and Opportunities

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Abstract

This paper explores the environmental impact of the super-linear growth trends for AI from a holistic perspective, spanning Data, Algorithms, and System Hardware. We characterize the carbon footprint of AI computing by examining the model development cycle across industry-scale machine learning use cases and, at the same time, considering the life cycle of system hardware. Taking a step further, we capture the operational and manufacturing carbon footprint of AI computing and present an end-to-end analysis for what and how hardware-software design and at-scale optimization can help reduce the overall carbon footprint of AI. Based on the industry experience and lessons learned, we share the key challenges and chart out important development directions across the many dimensions of AI. We hope the key messages and insights presented in this paper can inspire the community to advance the field of AI in an environmentally-responsible manner.